spot beyond radial area, piceous or black; the brown coloration also contains some paler spots; on the outer hyaline area there is a waved spot commencing at costa and crossing bases of first to fourth apical areas, some submarginal spots, a small spot on each side of the apices of longitudinal veins to apical areas, followed by a larger spot on extreme outer margin, piceous or black; wings black, their outer fourth pale hyaline.

Head (including eyes) about two thirds the width of base of mesonotum; rostrum reaching base of abdomen, its apex black; opercula broadly transverse, their inner angles overlapping, their outer and lateral margins moderately convex.

Long., excl. tegm., ♂ 20–22 mm.; exp. tegm. 72–76 mm.

Hab. N.W. China (*Dr. W. M. Crowfoot,* Brit. Mus.); W. China (*Pratt,* Coll. Dist.).

This species has a strong superficial resemblance to a very large example of *Platypleura nobilis*, Fabr., but belongs to the genus *Pycna* by the relative breadths of the head (including eyes) and the base of mesonotum.

Ugada Nutti, sp. n.

Allied in general coloration to *U. Stålina*, Butl., less so to *U. grandicollis*, Germ., from both of which it differs by the much longer and more acute lateral pronotal angles, the broader central sulcation to face, the opercula in male only nearly meeting, and not overlapping internally as in *U. Stålina*; rostrum reaching but not passing the posterior coxæ. By the shape of the pronotum it is more allied to *U. limbata*, Fabr., from which it differs by the pale castaneous wings, more sharply angulated lateral angles of pronotum, broader longitudinal sulcation to face.

Long., excl. tegm., ♂ ♀ 33 mm.; exp. pronot. angl., ♂ 21, ♀ $23\frac{1}{2}$ mm.; exp. tegm., ♂ 102, ♀ 112 mm.

Hab. Nyasa plateau, near Tanganyika (*W. H. Nutt,* Brit. Mus.).

The British Museum possesses one male and one female specimen.

XLVII.—*On a Pneumatic Type of Vertebra from the Lower Karroo Rocks of Cape Colony* (Tamboeria Maraisi). By H. G. Seeley, F.R.S.

In August 1889 I found at Tamboer Fontein, between Fraserburg Road Station and Fraserburg, an isolated vertebra, loose upon the surface, which differs in type from all reptiles known from the Karroo rocks of South Africa. It is in a poor state of preservation, having travelled from higher ground, and by rolling has lost the neural spine, zygapophyses, facets for the ribs, and is otherwise worn. But exposure has removed much of the intractable matrix, and I have cleared enough of what remained to show the more important characters of the vertebra. It is an inch and a half long, with the centrum laterally compressed, showing intercentral facets, with a central notochordal pit impressing the centre of each articular face. The neural arch is not conspicuously elevated, is somewhat widened in front, and is deeply excavated on the under surface for pneumatic foramina, in the manner seen in the cervical vertebræ of birds and vertebræ of Saurischian Dinosaurs. The external surface-layer of bone is dense and smooth.

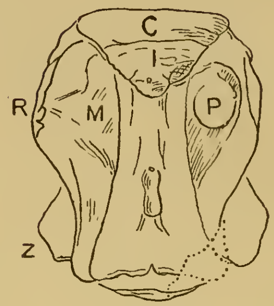
The anterior articular face of the centrum (fig. 1, C, p. 338) is wider transversely than deep, measuring fully six tenths of an inch from the neural canal to the notched-out articular facet for the intercentrum, and is eight tenths of an inch wide. This surface of the centrum is convex from the central pit outward, resembling the faces of the vertebræ preceding the caudal fin of an Ichthyosaur, suggesting free movement; but it is slightly rubbed and weathered.

The facet for the intercentral ossification (I) is triangular, wider than deep, placed below and behind the vertical articular face, and in lateral view looks obliquely forward and downward, is rounded from side to side, and has the aspect of excavating the base of the articular face (fig. 2, A.I).

The posterior articular face of the centrum (fig. 1) has a much smaller intercentral facet, chiefly resulting from its less depth and more lunate form. The total depth of the posterior surface of the vertebra a little exceeds the anterior depth (fig. 2, P.C), so that the articular face of the centrum was more nearly circular; it is inclined a little forward, making the measurement along the neural canal about one tenth of an inch shorter than along the ventral margin. A series of such vertebræ would be concave on the dorsal aspect, like the vertebræ of the neck, elevated in the usual way.

The body of the centrum measures about one inch and one tenth from front to back, along the narrow concave ventral surface, between the anterior and posterior margins of the intercentral facets. This inferior part of the body of the vertebra is somewhat flattened from side to side, with a deep median longitudinal groove in its middle length (fig. 1). It is compressed from side to side, with the transverse width reduced to little more than a quarter of an inch, at a quarter of an

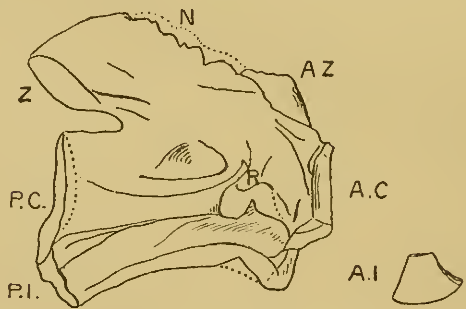
Fig. 1.



Cervical vertebra of *Tamboeria Maraisi*. Inferior aspect.

C. Anterior articular face.
I. Facet for intercentrum.
P. Pneumatic foramen under the neural arch.
M. Matrix.
R. Broken process for the cervical rib.
Z. Posterior zygapophysis.

Fig. 2.



Lateral aspect of the same.

A.C. Anterior face of centrum.
P.C. Posterior face of centrum.
A.I. Anterior intercentral facet, with restored section of intercentrum.
P.I. Posterior intercentral facet.
R. Articular surface for rib (broken) above the ridge which covers the pneumatic foramen.
Z. Zygapophysis.
N. Indication of base of the neural spine.
A.Z. Broken base of left anterior zygapophysis.

inch behind the anterior intercentral facet. Hence the sides of the centrum are concave in length, so that the lateral compression is greatest immediately under the attachment of the rib (fig. 2, R), where the pneumatic excavation seen from below occupies the anterior half of the length of the centrum.

The pneumatic impression or excavation is apparently situate between the centrum and the neural arch, though the neuro-central suture is obliterated. Seen from beneath (fig. 1) it is a pear-shaped or triangular cavity, wide in front and narrow behind, situate between the flattened compressed side of the centrum and the overhanging neural arch. On the underside of this anterior part of the arch, beneath the small broken process for the rib, is an oval hole (P), not unlike the pneumatic foramen seen in the wide cervical vertebræ of Cretaceous Ornithosaurs. In Ornithosaurs the foramen is below the ridge which extends between the anterior and posterior zygapophyses, but the ridge which forms the upper boundary of this foramen extends forward on the side of the centrum from the middle of its posterior articular face, with a concave lateral contour, which widens transversely to the position above the foramen, and then narrows towards the anterior articular face (fig. 2). The ridge is compressed and rounded from above downward. Above it in the middle of the side is a pit or depression, which separates this ridge on the centrum from the less conspicuous zygapophysial ridge above it, upon the neural arch, which is badly preserved. In morphological position this foramen makes an approximation to that seen laterally on the anterior part of cervical vertebræ of Saurischian reptiles, and especially to some of the Cetiosauria. But it differs from American types in the excavation being undivided vertically and in the foramen itself looking downward (fig. 1, P), so as to be invisible from the side (fig. 2).

The small transverse process above the foramen arches, somewhat in a penthouse form. Its fractured base is less than half an inch long. It was probably very short and may have been co-ossified with the cervical rib as in Saurischian types like *Cœlurus*, and in Ornithosaurs. There is necessarily no evidence as to its articulation with the intercentrum; but such a relation is found in the early vertebræ of *Cynognathus*, in which the intercentral ossifications are of larger size. The imperfect evidence suggests a condition for the cervical ribs intermediate between the Theriodontia and the pneumatic Megalosauria.

The neural canal is of moderate size and appears to be wider than deep, though the depth posteriorly is reduced by crush, which depresses the neural arch.

The neural arch is rather small, with strong, thick, large posterior zygapophysial processes, which diverge backward and outward, and are angulated superiorly. The facets, which are imperfectly preserved, look downward and outward. The anterior processes, which were small, are lost. The neural spine is lost. Its base was six tenths of an inch long; it appears to have been widest behind, and may have been channelled at the back, in harmony with the notch between the posterior zygapophyses. As preserved, the neural arch has the aspect of being inclined backward.

Taken as a whole, the characters of this vertebra shown on the facets for the intercentra and the articular faces of the centrum appear to me to indicate that the animal from which it was derived was an Anomodont, and not a Saurischian Dinosaur; and it differs from all known members of that group in possessing pneumatic vertebræ. It may therefore indicate a group of Pneumatospondylia, showing some affinity between the Anomodontia and Saurischian Dinosaurs, in which a similar pneumatic condition of the vertebral column is found. In the forms of the pelvic bones, especially the ilium and ischium, there are interesting resemblances between these groups, which extend also to various bones of the limbs, in some genera.

The locality which yielded this bone is chiefly remarkable for the remains of large animals, such as *Pareiasaurus* and *Tapinocephalus*; but at Cypher I found, in association with limb-bones and skull-fragments of those types, the figured fragment of a skull of the Lycosaurian genus *Pristerognathus*. I have seen no vertebrate remains, except those of Lycosauria from the Lower Karroo rocks of that part of Africa, which approximately correspond in size with the animal indicated by this vertebra. Lycosaurian vertebræ are unknown from African specimens.

There is a general resemblance in type to the vertebra named *Arctosaurus*, though that genus shows no indication of a pneumatic excavation or of intercentra. I followed the trail of travelled and broken bone-fragments up the slope down which they had been swept by the rains for a considerable distance without finding any further evidence of the animal, unless it is a much smaller crushed dorsal vertebra too distorted for description, which has some resemblance to *Arctosaurus*.

The name suggested for the species commemorates the locality, Tamboer Fontein, where it was found, and the friendly help of the gentleman, Mr. J. S. Marais, who aided me in collecting larger fossils upon his farm.

Doubt has of late been current concerning the significance of pneumatic foramina in fossil bones, and is put forward verbally and in print by Professor H. F. Osborn. In an article in the 'Century Magazine' for September 1904, similar in scope to the lecture given at Cambridge in August to the British Association, he enunciates the same views. Writing of *Ornitholestes*, Professor Osborn remarks:—"Externally its bones are simple and solid-looking, but, as a matter of fact, they are mere shells, the walls being hardly thicker than paper, the entire interior of the bone having been removed by the action of the same marvellous law of adaptation which sculptured the vertebræ of its huge contemporaries. There is no evidence, however, that these hollow bones were filled with air from the lungs, as is the case of the bones of birds."

Ornitholestes is compared with *Cœlurus*, *Hallopus*, *Ornithomimus*, and *Aristosuchus*. It is known from the skull, forty-five vertebræ, pelvis, and representative parts of both fore and hind limbs of one individual (Bull. Am. Mus. Nat. Hist. vol. xix. p. 459). But from the context quoted I gather that the author's conclusions should be applied not only to *Ornitholestes*, but to the pneumatic vertebræ of the largest Dinosaurs, possibly to all fossil pneumatic bones which are not referable to birds.

The current belief that a pneumatic vertebral column is evidence of the prolongation into the bones of air-cells from the lungs is an inductive conclusion, based upon the evidence from the parallel condition in the bones of birds. This evidence is affirmed by Prof. Osborn, in the passage quoted, not to exist, and in place of it he offers what is termed the "Law of Adaptation" as having sculptured these huge vertebræ. I have met with no enunciation of this law; and until it is explained how it differs in physiological action from the processes which sculpture or excavate the bones of birds, it will be difficult to judge whether we are offered a law, a suggestion, or only words, for no law will produce anatomical effects without corresponding physiological circumstances to sculpture the bones.

If the influence of pneumatic pressure produces a well-known osteological result in excavation of a bone in a bird, what is there in the vertebra of a Dinosaur to suggest that similar effects have been produced by dissimilar causes? And it would be interesting to find in an extinct order of animals evidence that an agency unconnected with the lungs produced results which differ from those in birds only in being the effect of larger areas of pressure acting laterally upon the sides of the vertebræ. But the evidence that there was any essential difference in the origin of these structures in Dinosaurs and birds is not forthcoming; and if it ever existed is lost with the soft parts of the animal.

Nevertheless cavities are formed in certain bones in animals of varied organization, which are not connected with the lungs in the manner of air-cells of birds, but they are chiefly in the skull. They are slightly developed in existing reptiles, but are most conspicuous in warm-blooded animals. The skulls of elephants exhibit a maximum development of pneumatic cavities which have no connexion with the lungs, and the texture of these bones closely approximates to that of cellular vertebræ in some Cetiosaurian Dinosaurs, such as *Ornithopsis* and its American representatives. The resemblance between the mammal skull and the reptile vertebra is one of analogy. There are no facts to support the inference that the cause which *expanded* the cranial bones of the elephant and other mammals is identical with that which absorbed and excavated the bony tissue, but did not augment the size of the cervical and dorsal vertebræ of Dinosaurs. There is no basis for comparison between the conditions in mammals and these extinct reptiles, for no mammal shows a pneumatic vertebral column which can be compared with these Dinosaurs; and when a mammalian vertebra is hollow it is not comparable, since there is no pneumatic foramen.

On the other hand, Dinosaurs are not conspicuous for pneumatic cavities in bones of the skull, and there are therefore no facts to suggest the idea that they might by analogy develop a pneumatic vertebral column which was not connected with the lungs, even if the cranial and vertebral pneumatic structures had been comparable.

The influence of the lungs as a whole in modifying the vertebral column of a reptile is manifest in the dorsal vertebræ of Testudinata. In tortoises, under conditions of terrestrial life, the lungs have expanded and given the carapace a remarkable elevation. At the same time the neural arches have become raised, and the lungs have pressed evenly against the sides of the centra of the vertebræ till they have become narrowed into thin plates by the tissue being absorbed laterally. But the lung never penetrates into the substance of the vertebra or excavates holes in the bones in existing reptiles comparable to those seen in skeletons of Dinosaurs, Ornithosaurs, and birds.

The influence of the lungs on the vertebral column of a Dinosaur as distinct from the air-cells may be, perhaps, inferred from the elevated condition of the neural arch and upward direction of transverse processes under which the lungs extended in such a type as *Diplodocus*, described by Prof. Osborn and the late Dr. J. B. Hatcher. It is reasonable to infer that the lungs were so large that their intermittent upward pressure stimulated the growth of the neuro-central suture to form the high neural arch; but as they were not confined by an unyielding envelope in the same way that the carapace confines the lungs of tortoises, there is but little lateral compression of the body of a vertebra as a consequence of absorption, which was localized laterally about the pneumatic foramen.

All down the vertebral column in *Diplodocus* the vertebræ are excavated, and the lateral holes were termed by Dr. Hatcher pleuro-central cavities. They have been well described in *Ornithopsis*. Their distinctive feature is that in the dorsal region the lateral foramina expand within the centrum into large chambers separated by a median vertical longitudinal partition, and each is commonly divided into unequal anterior and posterior parts by an imperfect vertical transverse lamina of bone. From this primary lateral cavity bone-cells commonly extend to the articular faces of the centrum and other parts of the vertebra. This condition of the pneumatic vertebræ is only dissimilar to that of birds in its details. In no existing animals except birds is a similar pneumatic structure found in the vertebral column, and it is only known in connexion with air-cells prolonged from the lungs. There is no fact to suggest that the lungs themselves were extended into the pleuro-central cavities of Dinosaurs: such an idea is not consistent with the pneumatic condition of the vertebræ in the elongated neck and tail. But with the general resemblance to the condition in the bones of birds it has been inferred that the pneumatic pressure, which was persistent enough to absorb the bone locally and laterally, was greater in Dinosaurs than in birds, because the cavities excavated are larger. Although this pressure, judged by its effects, was most potent in the dorsal region of the lungs, it also extended to the neck and tail, as in certain birds. It is therefore inferred that no cause is known except prolongation of air-cells from the lungs into the bones which is capable of producing these results, for from no other source in nature is the pressure derived which penetrates in this way into the skeleton.

This is inductive evidence from physiology and comparative anatomy. In place of it Professor Osborn has offered nothing except the following passage:—"The dominating principle in construction of the backbone is maximum strength with minimum weight. The ingenuity of sculpture by which this is brought about, every single vertebra differing from its fellow, baffles the Lamarckian as well as the Darwinian, and tempts us to revive the old teleological explanation" *. Teleology is not known as an element in science, and explains nothing.

XLVIII.—*Observations on Coleoptera of the Family* Buprestidæ, *with Descriptions of new Species.* By Chas. O. Waterhouse, F.E.S.

[Continued from p. 267.]

Chrysaspis glabra, sp. n.

Elongate, narrow, shining. Thorax blackish cyaneous, the sides tinted with green. Elytra golden green, very delicately punctured, suffused with coppery posteriorly.

Long. 29–31 mm.

Hab. "Dahr el Ghazal (*Colmant*)," "Arrouimi (*Duvivier*)" (*coll. Kerremans*).

This is an elongate narrow insect like *C. elongata*, Ol., but it is less parallel-sided (with a slight tendency to be elliptical) and more convex on the suture of the elytra. The disk of the thorax is nearly black, marked with fine punctures, which are not very close together; the sides are strongly and rather closely punctured. The elytra are bright golden green; the surface is extremely finely punctured and there are numerous slightly larger (but still fine) punctures, forming three double lines, representing the usual costæ, a few being also on the interstices. Prosternum blue. Abdomen greenish golden.

One specimen (♂) has only a trace of coppery colour near the apex of the elytra. In the second specimen (♀) the

* 'Memoirs American Museum of Natural History,' vol. i. part 5, p. 193, "A Skeleton of *Diplodocus*."